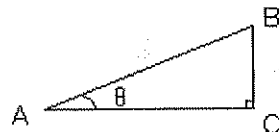


## TRIGONOMETRY, PYTHAGOREAN THEOREM AND VECTORS

The mathematical (numerical) analysis of vectors, compared to drawing scale diagrams, is a faster and more accurate means of determining the resulting answer to vector addition problems.

The three trigonometric functions of sine, cosine and tangent for right angle triangles are very important in the numerical analysis of vectors. Mastering the skill of using trigonometric functions is essential to many areas of science.

Consider the right-angle triangle shown in the margin. The angle at C is a right angle and the angle at A is an angle we will call  $\theta$ , pronounced theta. The lengths of the sides we will denote as p, q, and r.



You know several things about this triangle. For example, you know the Pythagorean relation:

How do we relate the resulting angles to the lengths of the sides? The answer is by defining three ratios (trigonometric functions) of the lengths of the sides in the triangle. These are sine, cosine, and tangent.

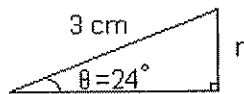
In order to make these trigonometric functions useful in calculations, we need numerical values of them for different values of  $\theta$ . NOTE: It is important that your calculator is set to degree mode.

Suppose that, for the above triangle, that  $\theta = 24^\circ$ . What is the sine of  $24^\circ$ ? Try it on your calculator – you should get 0.4067. What is the significance of this number?

Try cosine of  $24^\circ$ . What is the significance of this number?

Try tangent of  $24^\circ$ :

Understanding the meaning of the above trigonometric functions then enables you to determine information about the sides/angles of the triangle. For example, consider the triangle shown below. What is the length of the side opposite the angle?



Similarly, what would be the length of the side adjacent to the angle of  $24^\circ$ ?

Trigonometric functions also allow us to determine the angle. Consider the triangle below. What is the value of  $\theta$ ?

